Physics 131
General Physics I
Grinnell College

Homework VIII-IX

Session VIII.2

1. I have produced a standing wave on a rope 5 m long by driving one end with my hand, and have the other end tied to a fence. There are 3 nodes between the ends of the rope (that is, not including any nodes at either end of the rope—assume that my hand motion is small enough that my hand is approximately a node as well). What is the wavelength of the underlying wave? You should draw a sketch to help analyze this, and may want to look at the "Standing Wave" program again to be sure how to relate node spacing to wavelength.

Session VIII.3

2. A string is 1 m long. The wave velocity on the string is 50 m/sec. What are the lowest three resonant frequencies (harmonics) of this string?

3. A string of length 75 cm is excited in its fundamental (lowest) mode. It produces a sound wave with *sound* wavelength of 0.25 m. If the speed of sound waves is 300 m/sec, what is the frequency of vibration of the string? What is the speed of waves on the string?

Session IX.1

4. A sound is made by a speaker, which then radiates in all directions. The sound wave is described by

$$A(r)\sin(2r - 600t)$$

where the distances are in meters, and the time in seconds. The A(r) just indicates that the amplitude has some distance dependence--it decreases smoothly as the wave gets farther from the source

a) What is the velocity of this wave?

b) How long does it take for the sound to travel from the speaker to a listener 100 m away (the length of a football field)?

5. A wave is described by

$$\sin(3x + 4y - 20t).$$

a) What is the direction of propagation of this wave (give your answer in x,y coordinates, and as an angle)?

b) What is the velocity of this wave?